NASA Life Sciences Data Repositories: Tools for Retrospective Analysis and Future Planning

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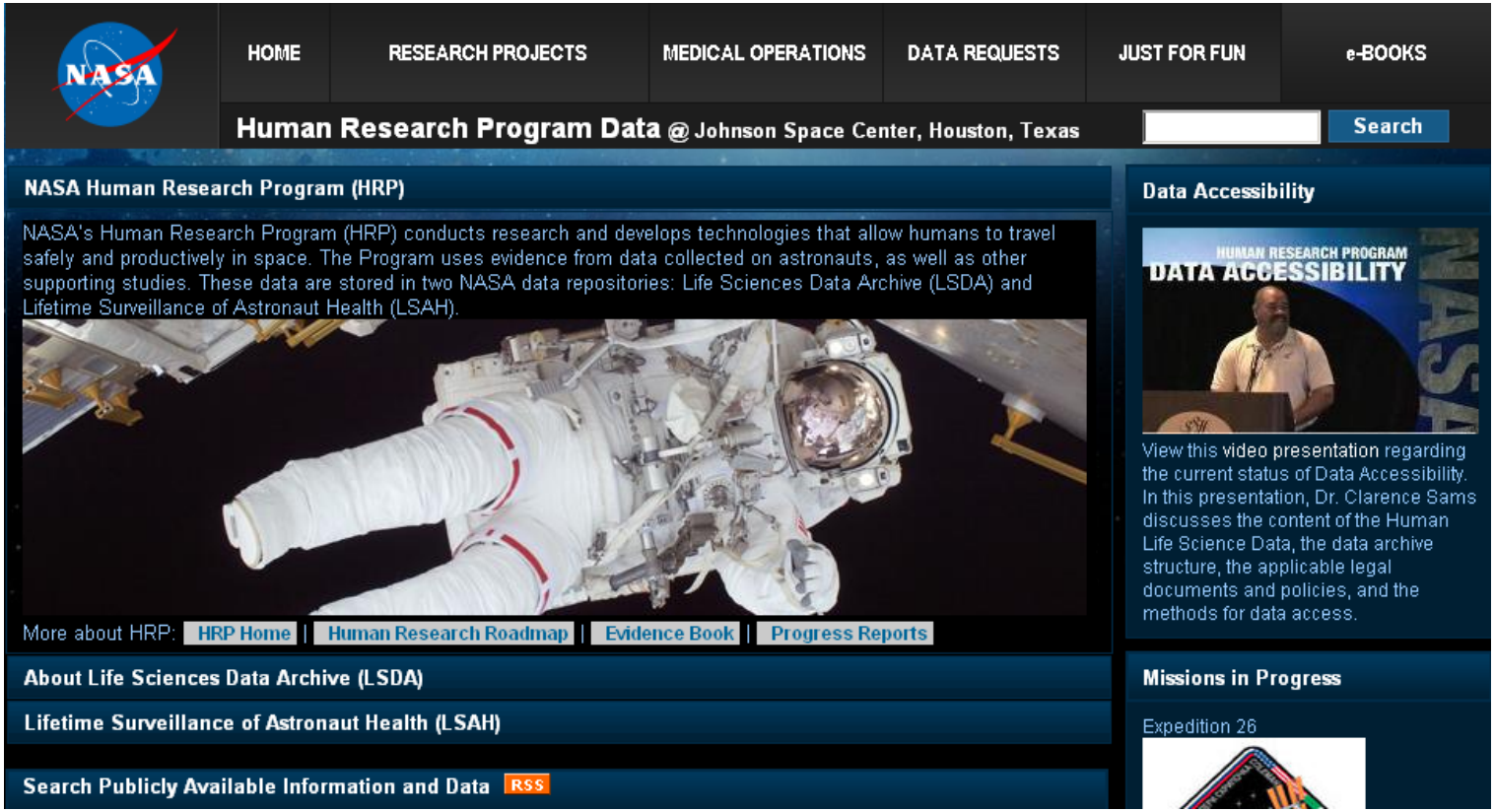
Data Repository Goals

- Enable combination of medical and research data where applicable to reduce astronaut spaceflight health and performance risks
  - Support operational and health care analyses
  - Support NASA research objectives
- Improve dissemination of and access to NASA life sciences data and information

Providing Data and Information to the Research and Operations Communities



Life Sciences Data Archive URL: http://lsda.jsc.nasa.gov

Online Searchable Catalog: Current Research Projects

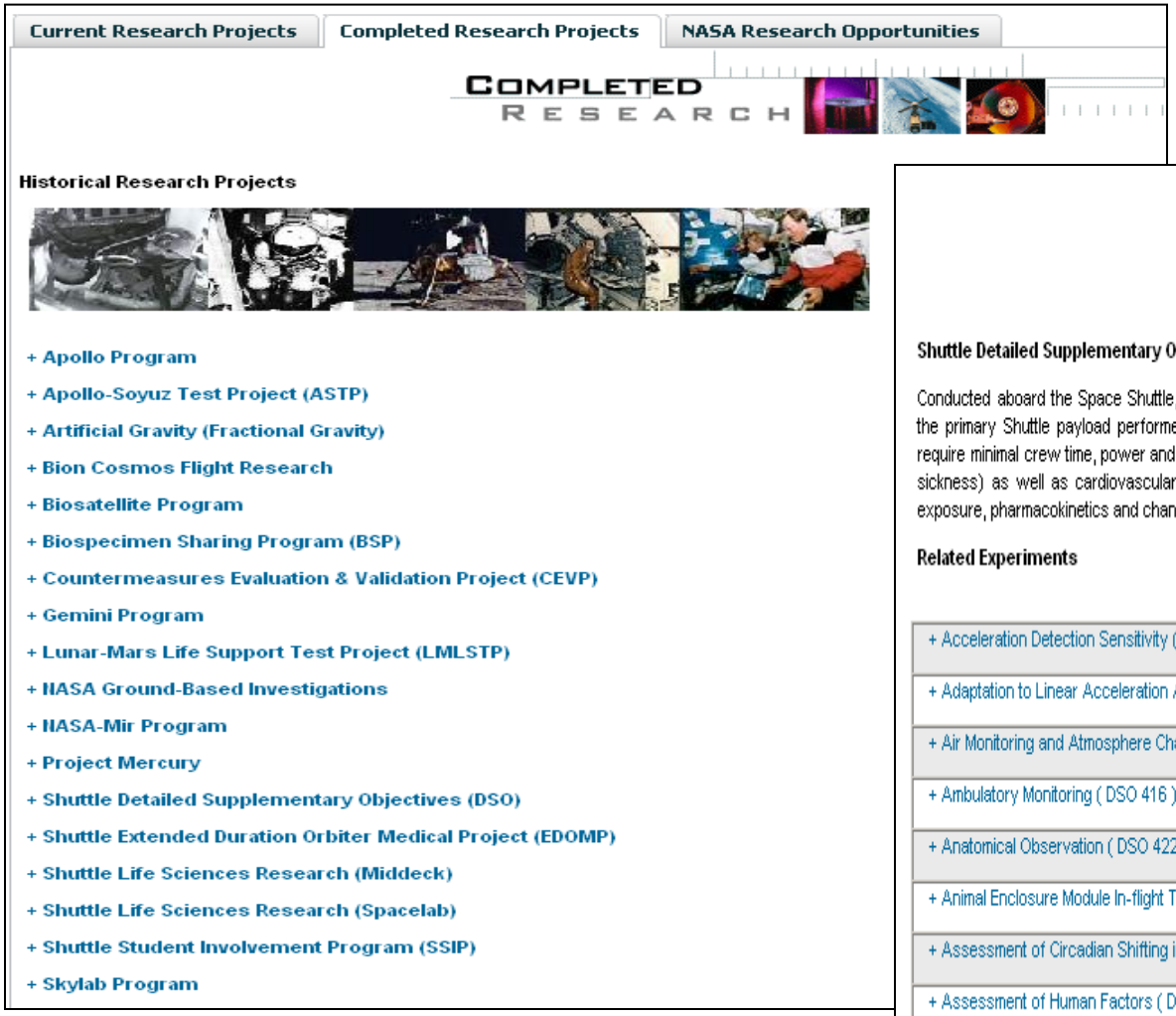
INFORMATION ABOUT THIS DATA

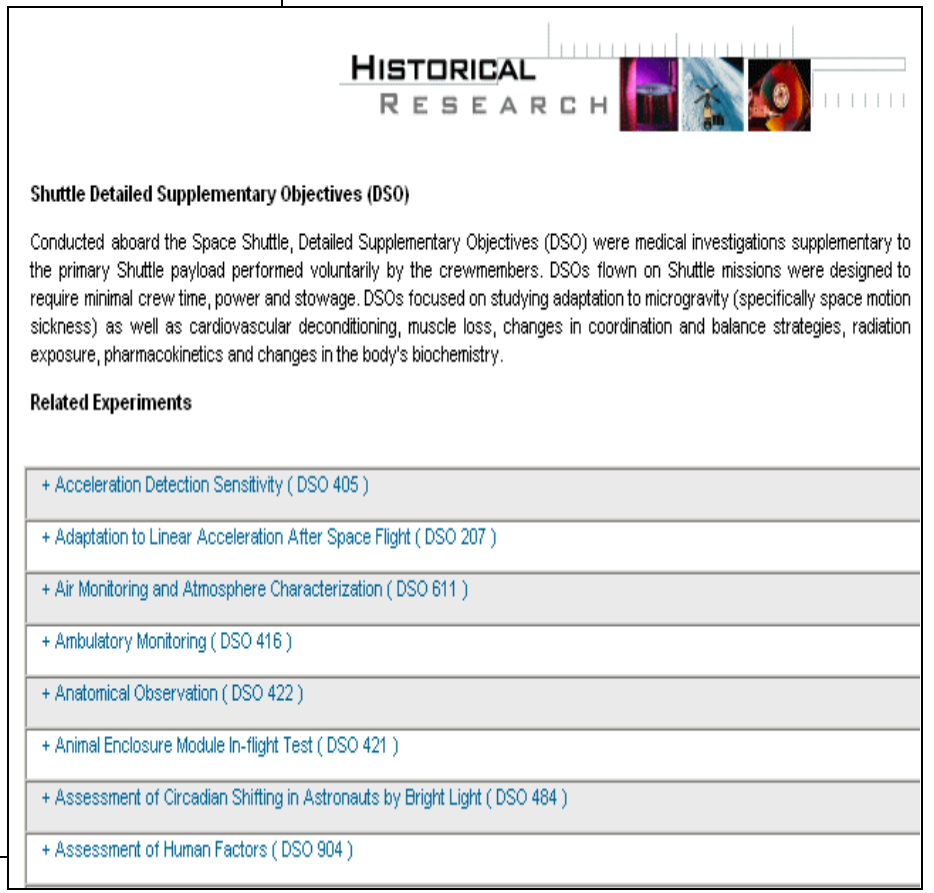
Data Set Name	Resting Gas Exchange in ISS Crewmembers
Data Set Description	Pulmonary function tests were performed on eight crewmembers (7 male, 1 female) of the International Space Station who performed a total of 15 extravehicular activities (EVAs) and who followed denitrogenation procedures approved for EVA from the International Space Station. Of those EVAs, nine were performed using the Russian Orlan suits and six were performed using the US Extravehicular Mobility Unit (EMU). Source: Prisk GK, Fine JM, Cooper TK, and West JB. Pulmonary gas exchange is not impaired 24 h after extravehicular activity. *J Appl Physiol* 2005;99:2233-2238.
Level of Processing	Analyzed - Microsoft Excel Spreadsheet
Data Files [Available online]	+ 96_E044_1950418134.xls File size : 35 kb **Download**
Measurements	Alveolar dead space (VDAlv) Alveolar ventilation (VA) Average inspiratory flow rate (VT/TI) Breathing frequency (fB) Cabin pressure Carbon dioxide production (VCO2)

Archived non-attributable data can be downloaded directly from the public website

Online Searchable Catalog: Completed Research Projects

A significant addition to the archive content is the Detailed Supplemental Objectives data





Research Publications: Electronic Books

Links are provided to related websites

CURRENT NASA PROJECTS:

Human Research Program (HRP)	Human Research Roadmap Evidence Book Science Progress Reports SPACELINE Current Awareness List selected recent publications of interest i
Lifetime Surveillance of Astronaut Health (LSAH)	The Lifetime Surveillance of Astronaut occupational surveillance program for and monitor astronauts for occupation Repository (LSAH-R) was established to implement a research component to enable analysis of astronaut medical data. View LSAH Newsletters
Medical Operations	The Medical Requirements Integration Document (MRID Book) defines integration activities to support the medical requirements (MR) for both short-duration and long-duration human space flight for the Space Shuttle/International Space Station (ISS) programs. Or View Individual Medical Requirements Recent publications: See ASTP and Skylab in Completed NASA Projects .
NASA Technical Reports Server	Since it was first released in 1994, the NTRS serves as a valuable resource for students, educators, researchers, and the public for access to NASA's current and historical technical literature.

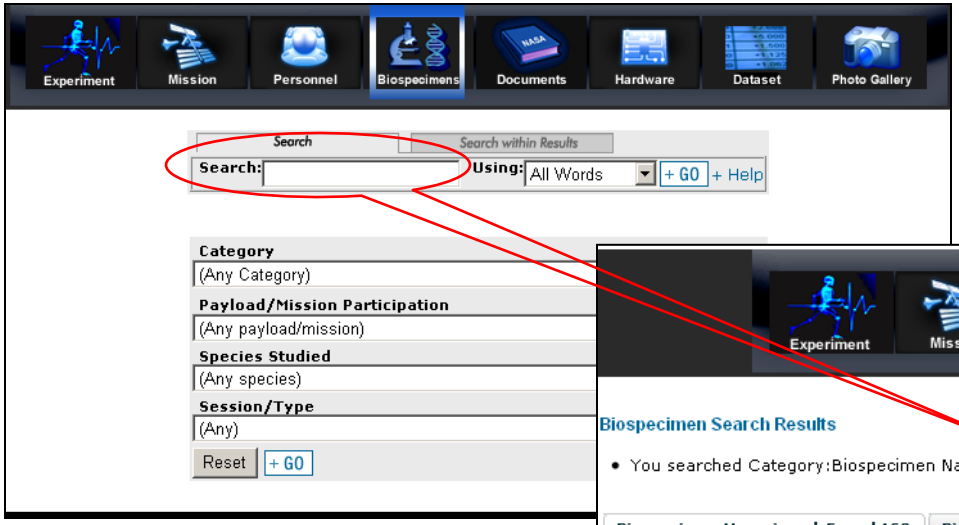
COMPLETED NASA PROJECTS:

Project Mercury	Space Medicine in Project Mercury
Gemini Program	Gemini Mid-Program Conference
Apollo Program	Biomedical Results of Apollo
Apollo-Soyuz Test Project	Medical Report
Skylab Program	Biomedical Results of Skylab Recent publications: The Skylab Medical Operations Project: Recommendations to Improve Crew Health and Performance for Future Exploration Missions
Shuttle Program	The Neurolab Spacelab Mission: Neuroscience Research in Space Extended Duration Orbiter Medical Project - Final Report
Lunar Mars Life Support Test Project (LMLSTP)	Isolation: NASA Experiments in Closed-Environment Living + Whole book + Each chapter
Fundamental Biology Animal and Plant Research	Life Into Space, Volumes 1, 2 and 3 - Fundamental Biology

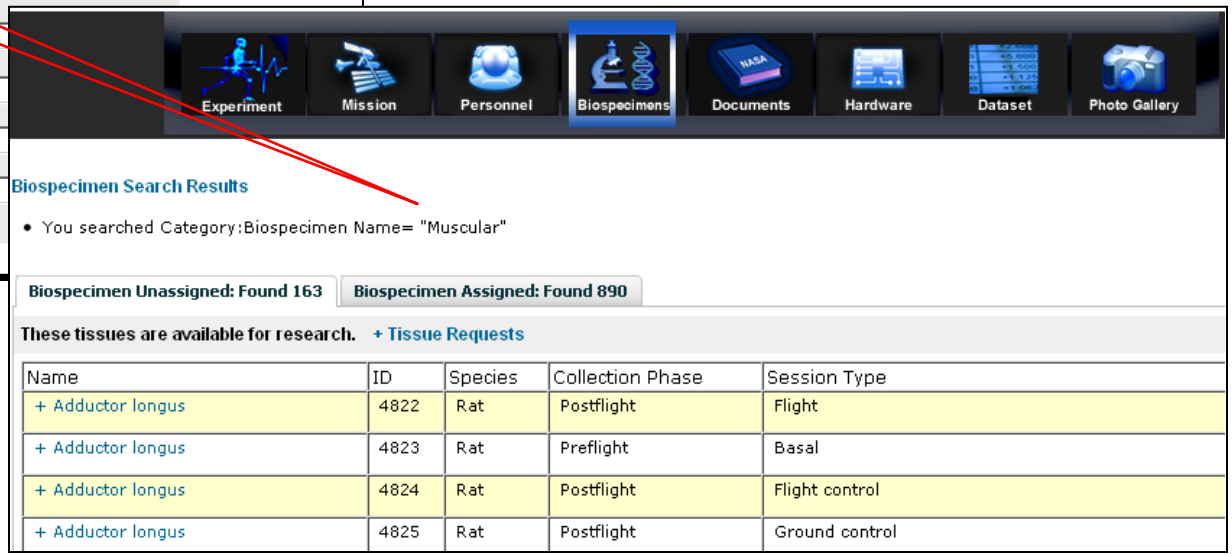
Research program publications can be read online or downloaded

Animal Research Data: Biospecimen Sharing Program

- Animal biospecimens include organisms that have flown in space and subjects of related ground control studies
  - Available samples are surplus (unassigned) biospecimens
- Applicants may submit proposals specifically for analysis of materials obtained from this program or as a supplementary component of an experiment proposal in another research area



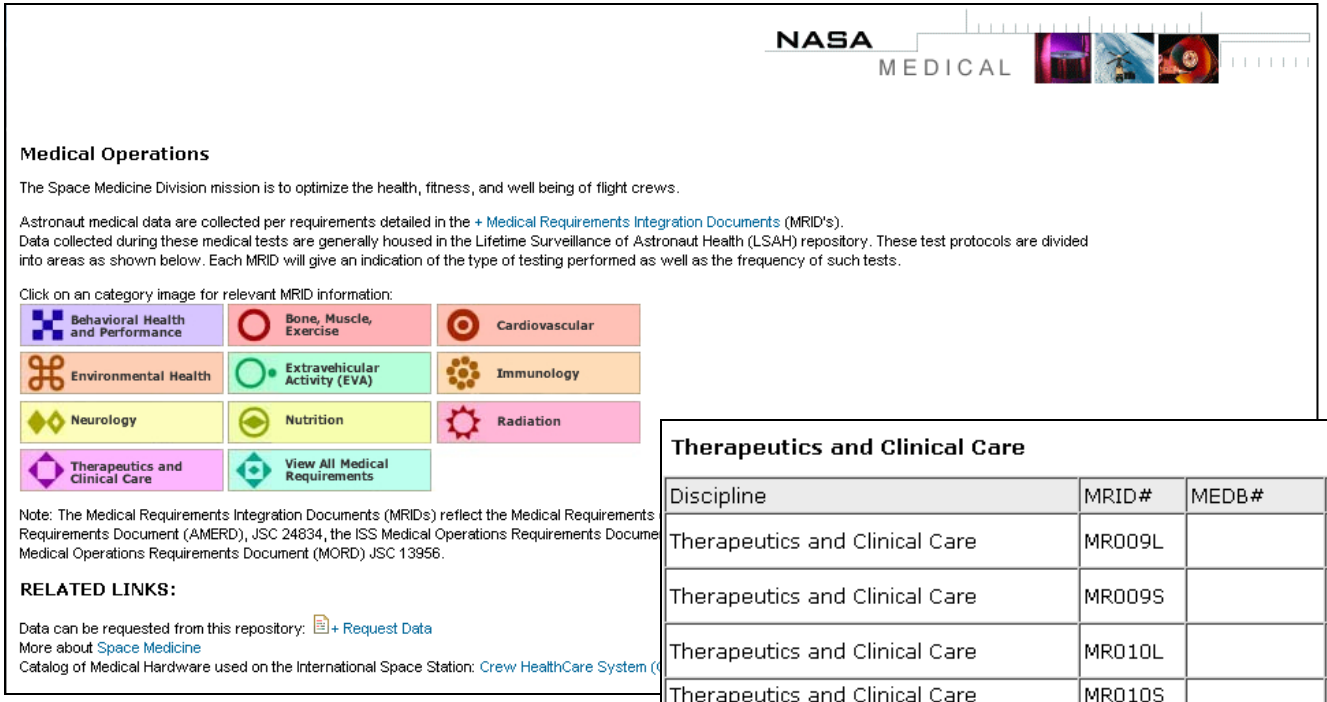
The search term "Muscular" returns the following result:



Clinical Data: Lifetime Surveillance of Astronaut Health

- The Longitudinal Study of Astronaut Health was closed out and control subjects were released in May 2010.
- The new LSAH program will continue to examine the incidence of acute & chronic morbidity and mortality of astronauts, and define the risks of morbidity and mortality associated with the occupational exposures encountered by astronauts.
- All astronauts selected into the US space program will be monitored throughout their NASA career and retirement from the astronaut corps.
- The major goals of the new program are:
  - Develop and Provide a Comprehensive Annual Medical Exam for each LSAH Participant
  - Conduct Occupational Surveillance
  - Improve Communication, Data Accessibility, Integrity and Storage
  - Support Operational and Health Care Analyses
  - Support NASA Research Objectives

Clinical Data:
Medical Tests Performed


NASA MEDICAL

Medical Operations

The Space Medicine Division mission is to optimize the health, fitness, and well being of flight crews.

Astronaut medical data are collected per requirements detailed in the + Medical Requirements Integration Documents (MRID's).
Data collected during these medical tests are generally housed in the Lifetime Surveillance of Astronaut Health (LSAH) repository. These test protocols are divided into areas as shown below. Each MRID will give an indication of the type of testing performed as well as the frequency of such tests.

Click on an category image for relevant MRID information:

Behavioral Health and Performance | Bone, Muscle, Exercise | Cardiovascular
Environmental Health | Extravehicular Activity (EVA) | Immunology
Neurology | Nutrition | Radiation
Therapeutics and Clinical Care | View All Medical Requirements

Note: The Medical Requirements Integration Documents (MRIDs) reflect the Medical Requirements Requirements Document (AMERD), JSC 24834, the ISS Medical Operations Requirements Docume Medical Operations Requirements Document (MORD) JSC 13956.

RELATED LINKS:

Data can be requested from this repository: + Request Data
More about Space Medicine
Catalog of Medical Hardware used on the International Space Station: Crew HealthCare System (

Annual medical exam & flight-related medical requirements

Therapeutics and Clinical Care

Discipline	MRID#	MEDB#	Medical Requirement Title
Therapeutics and Clinical Care	MR009L		+ Pre- and Postflight Physical Exam for Long Duration Crews
Therapeutics and Clinical Care	MR009S		+ Pre- and Postflight Physical Exam for Short Duration Crews
Therapeutics and Clinical Care	MR010L		+ Clinical Laboratory Assessment for Long Duration Flights
Therapeutics and Clinical Care	MR010S		+ Clinical Laboratory Assessment for Shuttle
Therapeutics and Clinical Care	MR011L	MEDB 1.6	+ Resting ECG
Therapeutics and Clinical Care	MR012L	MEDB 1.9	+ Dental Examination
Therapeutics and Clinical Care	MR013L		+ Audiometry for ISS
Therapeutics and Clinical Care	MR013S		+ Audiometry for Shuttle Crews
Therapeutics and Clinical Care	MR014L	MEDB 1.10	+ Ophthalmology Examination
Therapeutics and Clinical Care	MR014S		+ Pre- and Postflight Opthalmology Examination for Short Duration Flights
Therapeutics and Clinical Care	MR015L	MEDB 1.12	+ Ultrasound Imaging (Sonography)

Other data from tests performed for clinical purposes may also be available

Clinical Data: Access to LSAH Findings

- **Disseminate results of surveillance to participants, stakeholders, the research community, and the public**
  - The LSAH newsletter is published semi-annually as a communication vehicle for results gained through the surveillance process and changes to the program.
  - Surveillance results are also published in official NASA technical papers, books, and in peer-reviewed scientific journals
  - Other vehicles for communication of surveillance results are under development


National Aeronautics and Space Administration

The Lifetime Surveillance of Astronaut Health

Newsletter

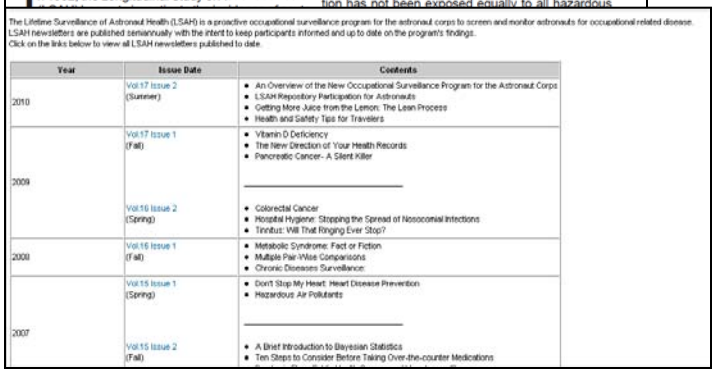
June 2010 Volume 17 • Issue 2

An Overview of the New Occupational Surveillance Program for the Astronaut Corps

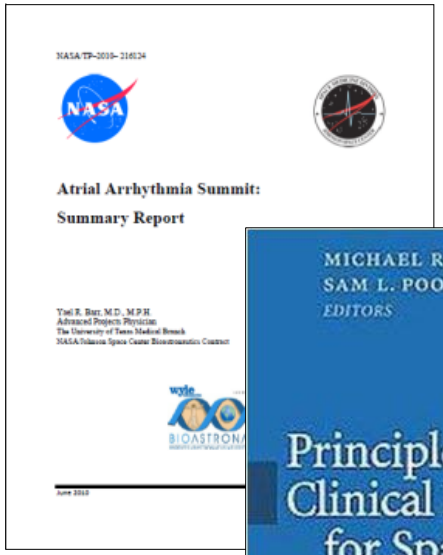
BY: HEATHER J. HARTNETT, PhD

In 1992, the Longitudinal Study of Astronaut Health

This program is designed to fit the medical follow-up care to the individual, since everyone in this popula-tion has not been exposed equally to all hazardous


The Lifetime Surveillance of Astronaut Health (LSAH) is a proactive occupational surveillance program for the astronaut corps to screen and monitor astronauts for occupational related disease. LSAH newsletters are published semiannually with the intent to keep participants informed and up to date on the program's findings. Click on the links below to view all LSAH newsletters published to date.

Year	Issue Date	Contents
2010	Vol 17 Issue 2 (Summer)	• An Overview of the New Occupational Surveillance Program for the Astronaut Corps • LSAH Repository Participation for Astronauts • Getting More Juice from the Lemon: The Lean Process • Health and Safety Tips for Travelers
2009	Vol 17 Issue 1 (Fall)	• Vitamin D Deficiency • The New Direction of Your Health Records • Pancreatic Cancer- A Silent Killer
	Vol 16 Issue 2 (Spring)	• Colorectal Cancer • Hospital Hygiene: Stopping the Spread of Nosocomial Infections • Tinnitus: Will That Ringing Ever Stop?
2008	Vol 16 Issue 1 (Fall)	• Metabolic Syndrome: Fact or Fiction • Multiple Pair-Wise Comparisons • Chronic Diseases Surveillance
2007	Vol 15 Issue 1 (Spring)	• Don't Stop My Heart: Heart Disease Prevention • Hazardous Air Pollutants
	Vol 15 Issue 2 (Fall)	• A Brief Introduction to Bayesian Statistics • Ten Steps to Consider Before Taking Over-the-counter Medications


NASA/TP-2010- 216124

Atrial Arrhythmia Summit:

Summary Report

Yael R. Barr, M.D., M.P.H.
Advanced Projects Physician
The University of Texas Medical Branch
NASA/Johnson Space Center Bioastronautics Contract

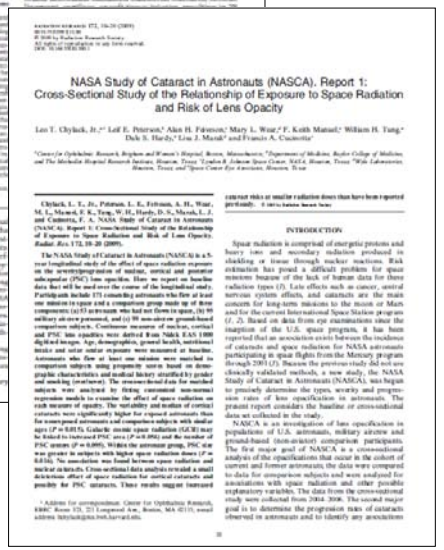

RESEARCH ARTICLE

Musculoskeletal Injuries and Minor Trauma in Space: Incidence and Injury Mechanisms in U.S. Astronauts

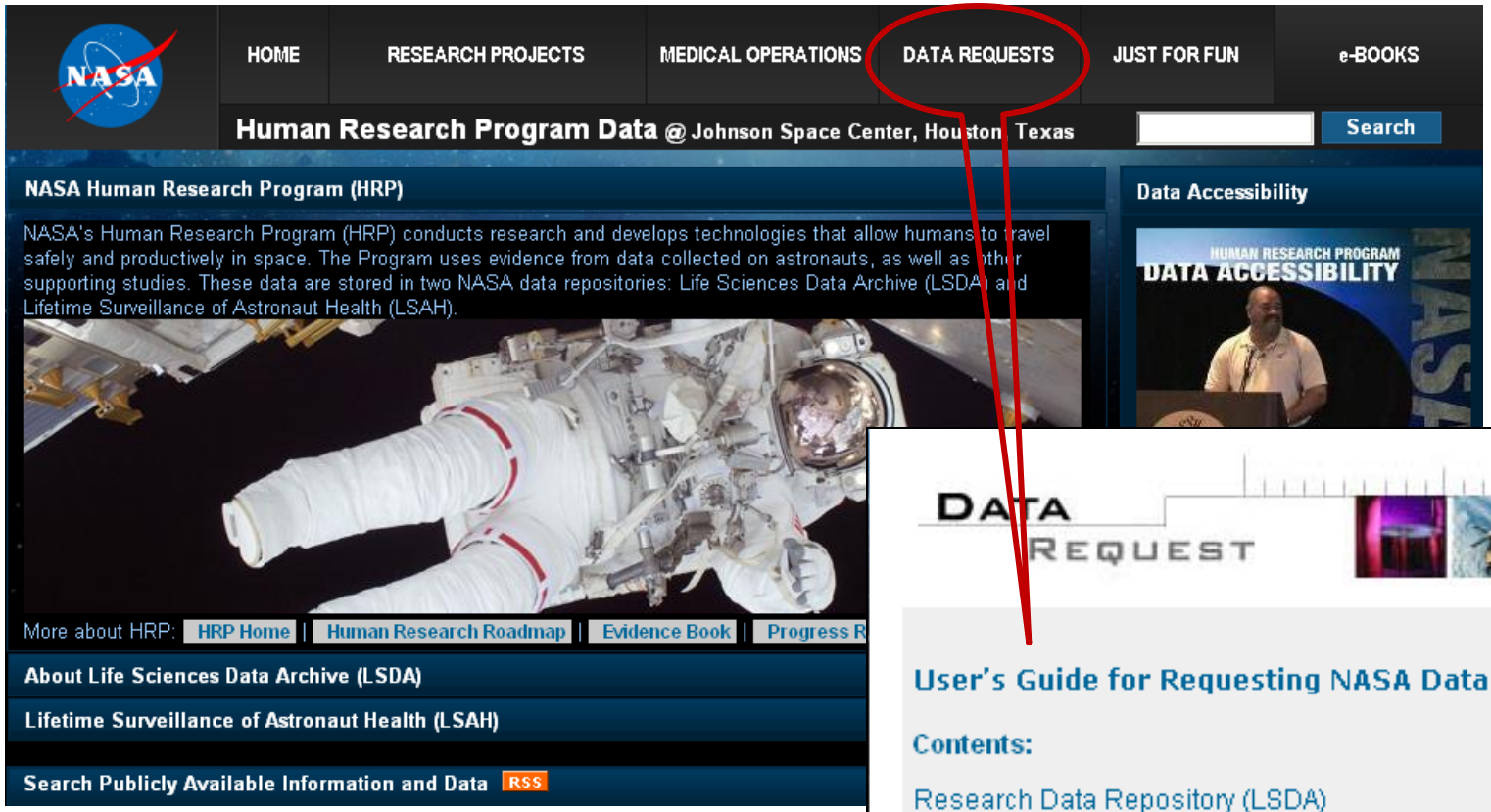

MICHAEL R. BARRATT
SAM L. POOL
EDITORS

Principles of Clinical Medicine for Space Flight

Springer

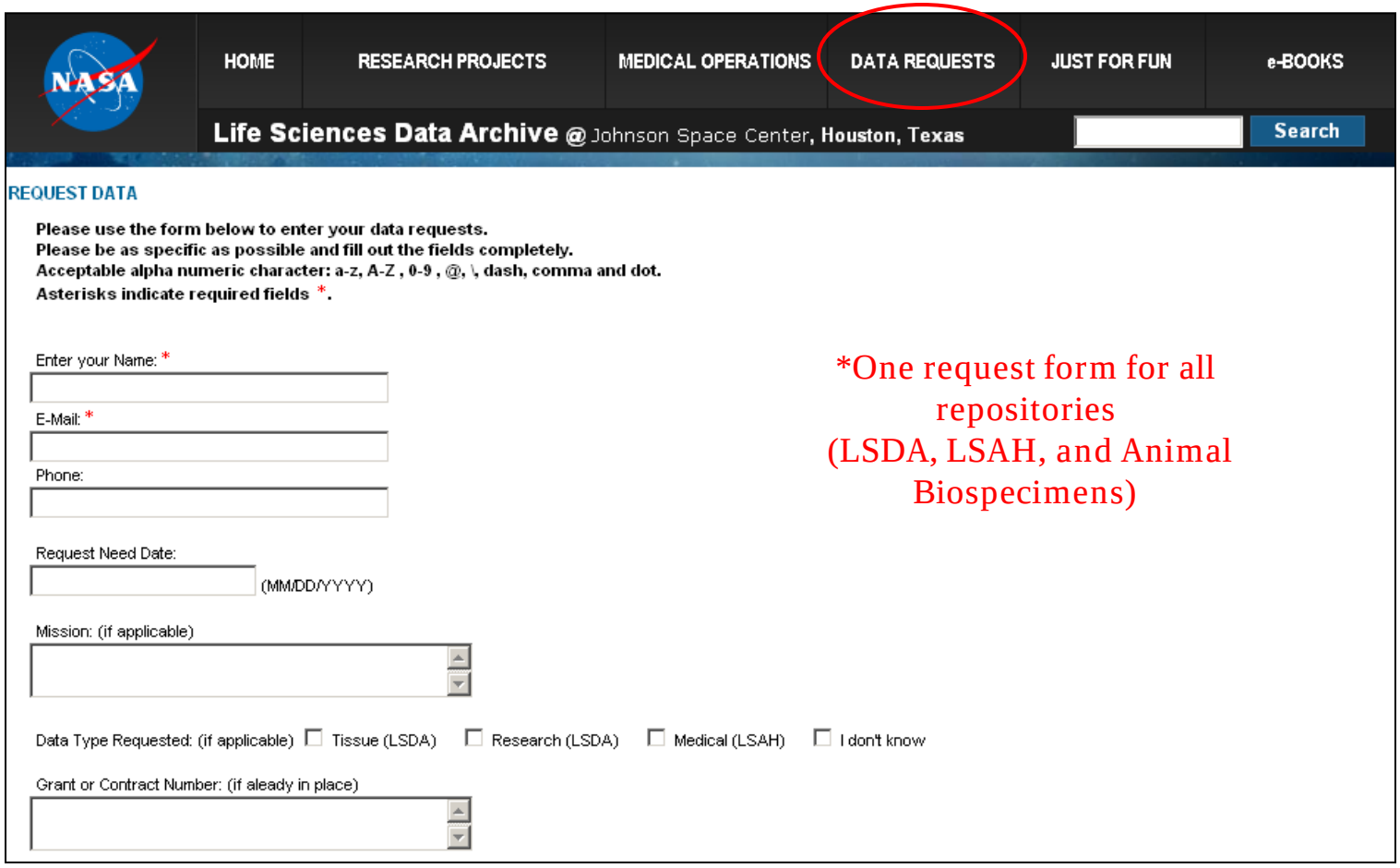

NASA Study of Cataract in Astronauts (NASCA). Report 1: Cross-Sectional Study of the Relationship of Exposure to Space Radiation and Risk of Lens Opacity

Data Request Portal for Research and Clinical Data



The portal provides guidance to researchers on requesting data from the LSDA and LSAH repositories

Online Data Request Form



*One request form for all repositories (LSDA, LSAH, and Animal Biospecimens)

Data Request Fulfillment

Data Request Clearinghouse

Automated email to requester

Obtain more info

Data Availability Check

LSAH Data

LSDA Data

Confirm with Requester

Request Approval Process:

- ✓ Request purpose?
- ✓ Merit established?
- ✓ Attributable data?
- ✓ Consent necessary?

Request not approved

Notify requester; modify request

Request approved

Requester notified of anticipated schedule; signs data use agreement

Assimilate Data from Various Sources

Mission Medical Records
LSDA Archive
Training Records
Clinic/LSAH Records
Vehicle Environmental Data
Biospecimen Data
Research Study/Laboratory Data
Questionnaires/Surveys

Retrieve missing data

Perform Data Quality Assurance

Data sent to Requester

Team Approach to Fulfilling Data Requests

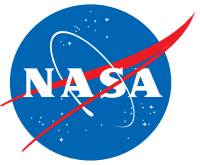
57 data requests completed October 1, 2010 through March 3, 2011

- **Provide data in response to Data Requests**
  - Data requests from flight surgeons, NASA management, subject matter experts, and researchers will be processed and dispositioned in an integrated manner.
  - Data requests will be processed jointly by LSAH and LSDA personnel to assure the requester is provided access to all available and relevant data
  - LSDA and LSAH will partner with each requester to understand their needs & provide the most relevant data, whether medical , research, or a combination of both.
  - Data requests in support of NRAs and RFPs

- **Sample uses of LSAH and LSDA data and information:**
  - Astronaut fracture incidence rates for current flight experiment background information
  - Incidence of corneal abrasion in Apollo crew due to lunar dust exposure to evaluate animal model
  - Interest in ISSMP Intravenous Fluid Generation (IVGEN) study for military application
  - Technical documentation on ISS treadmill and cycle ergometer vibration isolation systems
  - Intraocular Pressure Data– historical LSAH/LSDA data to understand evolving issue
  - Medical event data to populate a Space Medicine Exploration Medical Condition List
  - Integration of Evidence Base into a Probabilistic Risk Assessment (“Integrated Medical Model”)

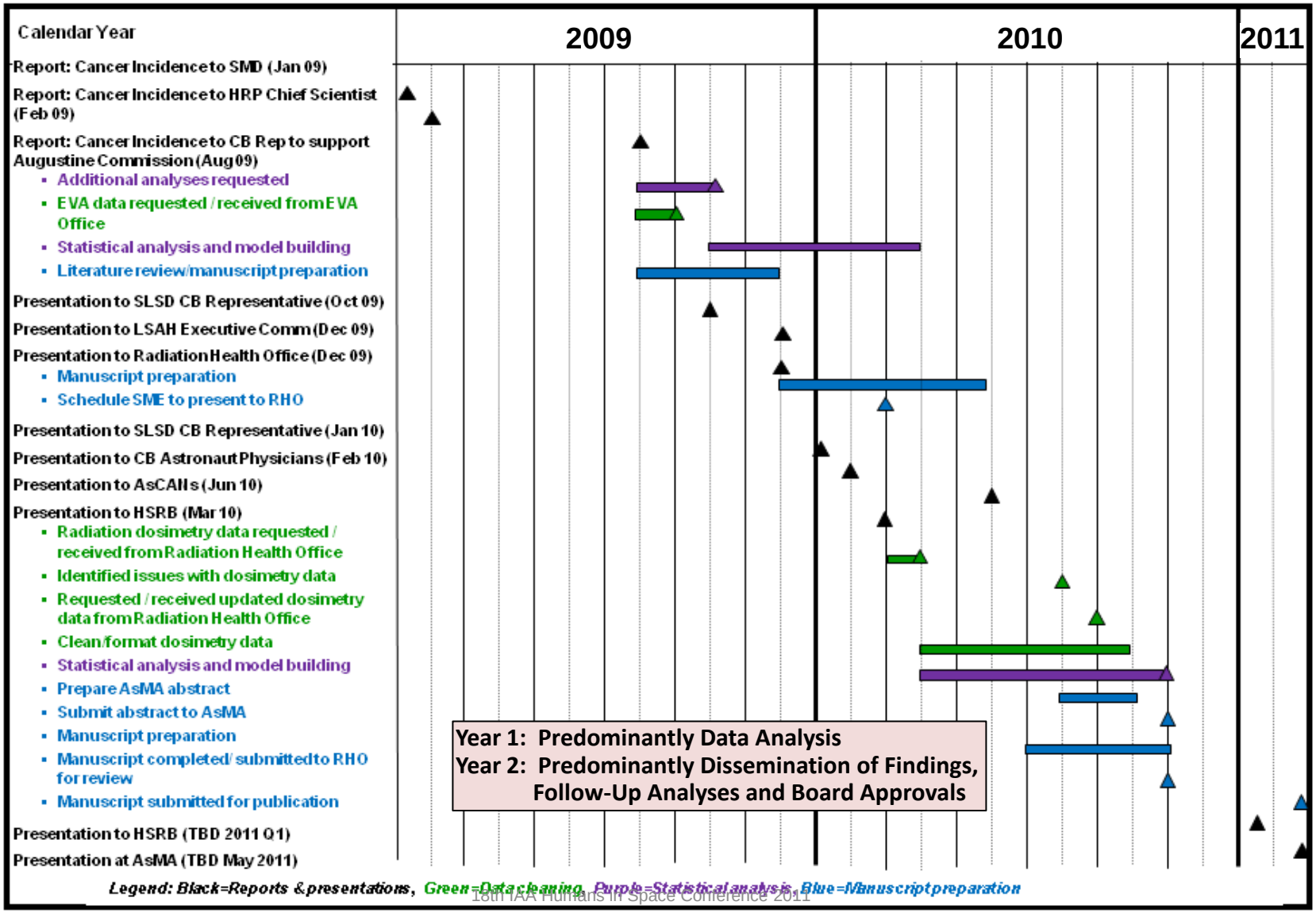
Plans for the Future

- **LSDA Content Expansion:**
  - Historical Detailed Supplemental Objectives (almost complete)
  - Historical Detailed Technical Objectives (in progress)
  - HRP Directed Research (in progress)
  - Flight Analog Extramural Studies (ongoing)
  - Future Desired Content
    - NSBRI Ground-based Studies
    - International Partner Studies
- **LSAH Occupational Surveillance Data:**
  - Develop individual exposure profiles, additional annual screening tests
  - Increased surveillance for spaceflight medical events, associated health trends
  - Conduct operational investigations (e.g., shoulder injury; intraocular pressure)
- **Early involvement in NRA and CPHS processes to facilitate data availability**
- **Consent astronauts for future uses of data**
  - LSAH: use of medical data for research purposes
  - LSDA: use of existing research data for future research studies

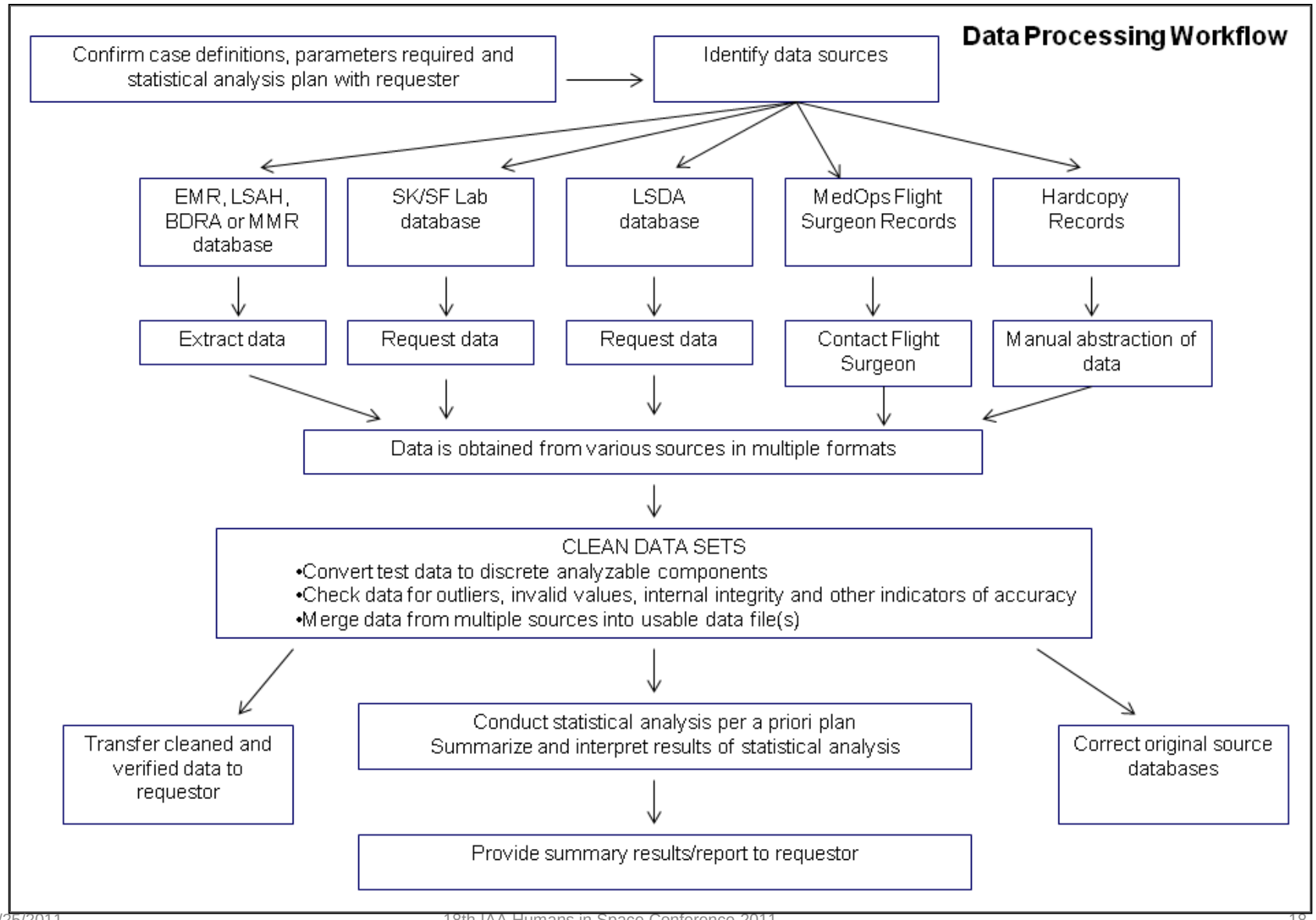


Backup Slides

Data Analysis Timeline Example: Cancer Morbidity



Data Processing Workflow



Abstract

- As NASA transitions from the Space Shuttle era into the next phase of space exploration, the need to ensure the capture, analysis, and application of its research and medical data is of greater urgency than at any other previous time. In this era of limited resources and challenging schedules, the Human Research Program (HRP) based at NASA's Johnson Space Center (JSC) recognizes the need to extract the greatest possible amount of information from the data already captured, as well as focus current and future research funding on addressing the HRP goal to provide human health and performance countermeasures, knowledge, technologies, and tools to enable safe, reliable, and productive human space exploration. To this end, the Science Management Office and the Medical Informatics and Health Care Systems Branch within the HRP and the Space Medicine Division have been working to make both research data and clinical data more accessible to the user community.

Abstract (continued)

- The Life Sciences Data Archive (LSDA), the research repository housing data and information regarding the physiologic effects of microgravity, and the Lifetime Surveillance of Astronaut Health (LSAH-R), the clinical repository housing astronaut data, have joined forces to achieve this goal. The task of both repositories is to acquire, preserve, and distribute data and information both within the NASA community and to the science community at large. This is accomplished via the LSDA's public website (http://lsda.jsc.nasa.gov), which allows access to experiment descriptions including hardware, datasets, key personnel, mission descriptions and a mechanism for researchers to request additional data, research and clinical, that is not accessible from the public website. This will result in making the work of NASA and its partners available to the wider sciences community, both domestic and international. The desired outcome is the use of these data for knowledge discovery, retrospective analysis, and planning of future research studies.